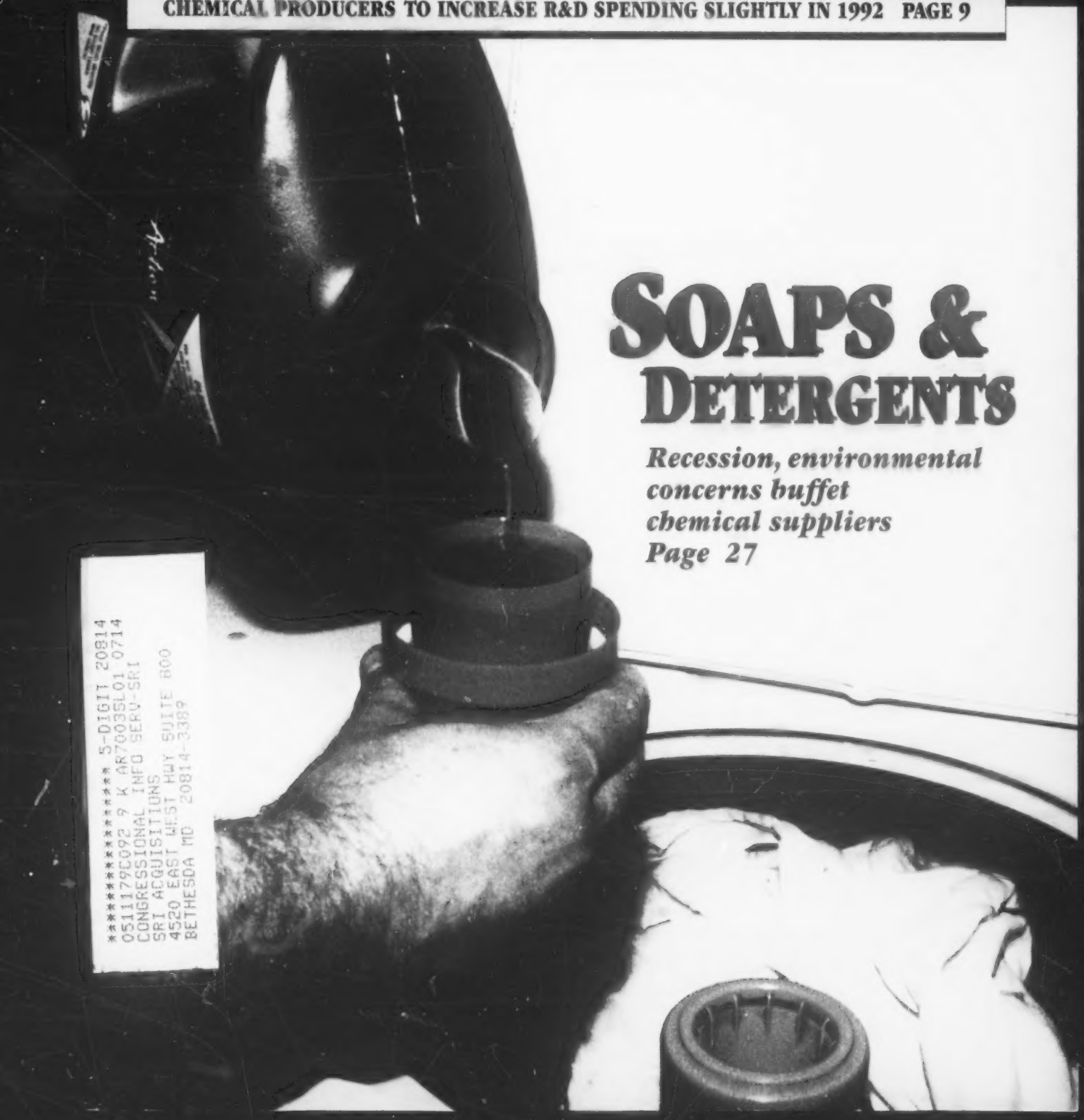
CHEMICAL & ENGINEERING NEWS

C&EN

JANUARY 20, 1992

CHEMICAL PRODUCERS TO INCREASE R&D SPENDING SLIGHTLY IN 1992 PAGE 9



# SOAPS & DETERGENTS

***Recession, environmental concerns buffet chemical suppliers***
***Page 27***

********** S-DIGIT 20814
05111790092 9 K AR700350L01 0714
CONGRESSIONAL INFO SERV-SRI
SRI ACQUISITIONS
4520 EAST WEST HWY SUITE 800
BETHESDA MD 20814-3389

CHEMICAL & ENGINEERING NEWS

C&EN

JANUARY 20, 1992

## NEWS OF THE WEEK

- Although labeled a failure by critics in the U.S. and Japan, President Bush's recent trip to Japan is called a success by chemical executive who was in U.S. delegation. Page 4
- French scientists have crushed buckminsterfullerene to diamond by applying high pressure at room temperature. Page 5
- Potential cure for cystic fibrosis using a genetically engineered adenovirus has been worked out by researchers at NIH. Page 5
- Oceanographic research ship begins international study of environmental damage to Persian Gulf region caused by massive oil spill during the war. Page 6
- Bacteriorhodopsin-based photocell developed by Japanese chemists reacts to instantaneous changes in light intensity, could provide basis for development of artificial vision devices, optical computers. Page 6

COVER: Photo by C&EN's Ernest L. Carpenter

Volume 70, Number 3
CENEAR 70 (3) 1–72
ISSN 0009-2347

## BUSINESS

**Major U.S. chemical firms plan a 4% boost in R&D spending** on average this year, following a decrease of 2% in 1991, according to C&EN's annual survey. Page 9

**Western European chemicals production will grow modestly** in 1992, at least better than last year, forecasts CEFIC, the European Chemical Industry Council. Page 12

## GOVERNMENT

**Global environmental revolution must be initiated,** says Worldwatch Institute, as a prerequisite for the UN's June Earth Summit meeting, which is expected to develop an action plan for sustainable development. Page 18

## SCIENCE/TECHNOLOGY

**Scientists can view surface atoms on the move** via a transmission electron microscope technique developed by University of Illinois researchers, thus enabling them to observe microstructural changes occurring during a processing operation. Page 21

**Unusual backbone structures can be incorporated into proteins** using a biosynthetic method worked out by chemists at the University of California, Berkeley. Page 22

## PRODUCT REPORT

**The recession and concern about the environment are affecting virtually every move made by U.S. soap and detergent manufacturers and their suppliers.** Page 27

LETTERS 2

CONCENTRATES

Business 7

Government 17

Science/Technology 20

THE DEPARTMENTS

Software/Database Update 24

New Products 45

Newscripts 72

**Chemical & Engineering News**
1155—16th St., N.W., Washington, D.C. 20036

**Editor:** Michael Heylin
**Assistant Managing Editors:** James H. Krieger, Janice R. Long, Rebecca L. Rawls, Donald J. Soisson, William J. Storck
**Staff Editor:** Ernest L. Carpenter
**Senior Correspondents:** Earl V. Anderson, Lois Ember, Wilbert C. Lepkowski
**News Editor:** Richard J. Seltzer
**Senior Editors:** New York: Stephen C. Stinson; Chicago: Joseph Haggin; London: Patricia L. Layman; Washington: Stuart A. Borman, Doron Dagani, Bette Hileman, Pamela S. Zurer
**Associate Editors:** Mairin B. Brennan, Ann Marie Menting
**Service Departments Editor:** Dolores Miner
**Editing Services:** Arlene Goldberg-Gist (Head), Rita E. Johnson (Editorial Assistant), Patricia Oates (Administrative Assistant)
**News Bureaus:** Northeast News Bureau: (908) 906-8300 Ann M. Thayer (Head), Marc S. Reisch (Associate Editor), Rachel Eskenazi (Administrative Assistant). Chicago: (708) 256-4143 Ward Worthy (Head). Houston: (713) 973-8162 Susan J. Ainsworth (Associate Editor). Washington: (202) 872-4495 David J. Hanson (Head). West Coast: (415) 653-3630 Rudy M. Baum (Head). **Foreign Bureau:** London: (01) 540-0414 Dermot A. O'Sullivan (Head)
**Graphics and Production:** Leroy Corcoran (Head). Barbara Fryer (Art Director). Linda Mattingly (Staff Artist). Diane Kelly (Costing)
**Composition Systems Administrator:** Vincent L. Parker. **Assistant:** Robin L. Shapiro
**Business Manager:** Arthur Poulos
**Circulation Director:** David Schulbaum

**ADVISORY BOARD:** F. Peter Boer, George Castro, Renée G. Ford, Louis J. Glunz, Kenneth G. Hancock, Harry S. Hertz, Cynthia A. Maryanoff, Linda B. McGown, David A. Shirley

Published by
AMERICAN CHEMICAL SOCIETY
(202) 872-4600; TDD (202) 872-4432
John Kistler Crum, Executive Director
Robert H. Marks, Director, Publications Division

**PUBLISHING BOARD:** Ned D. Heindel *(Chairman); Board of Directors Chairman:* Joseph A. Dixon; *President:* Ernest L. Eliel; Richard L. Deming; Judith C. Giordan; William P. Jencks; and Gary J. Long

**Subscription & Member Record Service:** Send all new and renewal subscriptions with payments to: ACS, Dept. L-0011, Columbus, Ohio 43268-0011. Correspondence and telephone calls for changes of address, claims for missing issues, subscription orders, status of records and accounts should be directed to: Manager, Member & Subscriber Services, ACS, P.O. Box 3337, Columbus, Ohio 43210; (800) 333-9511 or (614) 447-3776.

For changes of address, include both old and new addresses with ZIP code numbers and mailing label from a recent issue. Allow four weeks for change to become effective. Claims for missing numbers will not be allowed if loss was due to failure of notice of change of address to be received in the time specified; if claim is dated (a) North America: more than 90 days beyond issue date, (b) all other foreign: more than one year beyond issue date; or if the reason given is "missing from files."

**Subscription Rates 1992:** Printed editions: nonmembers U.S. 1 yr. $105, 2 yr. $189; outside U.S. 1 yr. $141, 2 yr. $261. Air freight rates available on request. Rates above do not apply to nonmember subscribers in Japan, who must enter subscription orders with Maruzen Co. Ltd., 3-10 Nihonbashi 2-chome, Chuo-ku, Tokyo 103, Japan. Tel: (03) 272-7211. Single copies: Current $15. Rates for back issues and volumes are available from Microforms & Back Issues Office, ACS, 1155—16th St., N.W., Washington, D.C. 20036. Back and current issues available on microfilm and microfiche. Rates on request from Microform Program, ACS.

Chemical & Engineering News (ISSN 0009-2347) is published weekly except for the last week in December by the American Chemical Society at 1155—16th St., N.W., Washington, D.C. 20036. Second-class postage paid at Washington, D.C., and additional mailing offices. POSTMASTER: Send address changes to Chemical & Engineering News, Membership & Subscription Services, P.O. Box 3337, Columbus, Ohio 43210. ACS assumes no responsibility for the statements and opinions advanced by the contributors to its publications.

**Advertising Management:** CENTCOM LTD.
(For list of offices see page 71)

**Office of Ombudsman:** (800) ACS-5558, No. 8–5
© Copyright 1992, American Chemical Society
Canadian GST Reg. No. R127571347

# LETTERS

## Looking to the future

I wish to congratulate John Verkade on his election as director of Region V. As one of the candidates in the recent election, this was my first opportunity to observe, firsthand, ACS politics at work on the national level. Several aspects of the election were disappointing, but the small number of ballots cast in the election was particularly so. I hope this is not an indication of member apathy, but simply of the fact that our members are too busy to take time to return their ballots. Also, even though our society has strict regulations about the use of society publications in campaigning, these are often difficult to enforce. All candidates are certainly entitled to equal and fair treatment, and those who run the elections should make every effort in the future to ensure this.

Our society would only suffer with an extended investigation in regard to this election, and our energies can be better directed for the good of the society. Let's put this election behind us and look to the future. The society and the chemistry profession have several pressing problems, which, if not addressed, could result in grave consequences for our profession.

Although I will not be serving on the ACS Board of Directors, I will continue my activities as a councilor, as a member of the Division of Professional Relations, and as a member of the Economic Status Committee, to bring about vitally needed changes to improve the economic and professional status of our members. As the economy of our nation continues to falter, our task becomes even more arduous. My activities are not tied to title, but to my continuous concern about the responsibility of ACS to its large majority of members whose interests we must address. I want to thank my supporters for their help and I ask them to put this election behind them and help me in my efforts to improve our society.

**E. Ann Nalley**
*Professor of Chemistry*
*Cameron University*

## Michael Faraday

I found your article on Michael Faraday (C&EN, Sept. 23, 1991, page 17) very interesting. Faraday was a great man and a great scientist and it is impossible to remember all his discoveries and ideas, but I would like to add a further contribution to demonstrate his widely skilled genius.

Some years ago I published a review on historical aspects of dust explosions. During my research, I came across an article by Faraday and C. Lyell, "Report on Explosion at the Haswell Collieries," published in 1845 in *Philosophical Magazine*.

At that time, Faraday's expert help was often called for in court. As a matter of fact, the article I found is a report presented in court and referring to the explosion in Haswell Collieries, which caused 95 deaths.

Faraday was the first scientist to realize that the explosions in mines, previously attributed only to firedamp, could also be caused by coal dust.

In retrospect, Faraday's work in this field might seem insignificant compared with his important, well-known discoveries, but it helped to make the scientific community and the public realize that solid materials dispersed as dust clouds in air can explode even without flammable gases.

Faraday first explained the phenomena and then contributed to the development of safety measures not only in mines, but also in every industry where flammable dusts are used.

It was very moving to read Faraday's original paper. Today his remarks and perceptions are found in textbooks on dust explosions as axioms.

**Paolo Cardillo**
*Stazione Sperimentale per i Combustibili*
*San Donato Milanese, Italy*

In school (Arbor View Elementary, Glen Ellyn, Ill.) my challenge program teacher, Mrs. Tucker, asked us to pick a creative problem solver to write a report on. I picked Michael Faraday. I started to get interested in him when I read your article, "Michael Faraday Feted on 200th Anniversary of His Birth." You guys are awesome article writers! I thank Stu Borman for writing a very interesting and thorough article.

For my report, I also got some more

## Correction

- Jan. 6, page 32: ACS cannot continue to send C&EN and journals after Feb. 29, not March 31, to those members whose 1992 dues and subscriptions are not received by Feb. 1, not March 1.

**Authorization to photocopy** any article for internal or personal use beyond the fair use provisions of the Copyright Act is granted by ACS to libraries and other users registered with the Copyright Clearance Center (CCC), provided that the fee of $3.00 per article copy is paid directly to CCC, 27 Congress St., Salem, Mass. 01970, USA. Copying for other than internal or personal use without express permission of ACS is prohibited. Address requests for customized bulk reprints to ACS Copyright Administrator, 1155—16th St., N.W., Washington, D.C. 20036, or call (202) 872-4367. The CCC Code for C&EN is 0009-2347/92 $3.00.

# Chemical Industry R&D Spending To Increase Slightly

■ ***Twelve major chemical producers plan 4% hike in research expenditures this year, translating to 2% rise in constant-dollar terms***

**Marc S. Reisch,**
C&EN Northeast News Bureau

C&EN's just-completed survey of 15 major chemical companies and nine diversified companies that produce chemicals show that most plan to increase research and development spending modestly in 1992.

However, a proposal expected in President Bush's economic recovery package this month making an R&D tax credit a permanent part of the tax code might help boost 1992 R&D spending beyond the survey's projected 4% increase for 12 chemical companies (three of the 15 firms surveyed haven't released 1992 projections). For now, though, the economy has forced companies to restrain increases in their R&D expenditures and direct more effort to achieve short-term product development goals.

According to the survey, the 15 chemical companies estimate that their R&D spending in 1991 decreased an average of 2% from the year before. In recent years, average annual increases for the group were much greater: In 1990, the R&D spending for the group increased 10% over the previous year, 8% in 1989, 9% in 1988, and 8% in 1987.

As the economy soured, and the business outlook for individual companies changed, many companies' priorities changed, too. Of the 15 chemical companies surveyed, Du Pont, W. R. Grace, Hercules, Olin, and Union Carbide have reorganized themselves. Over the past year they have sold or plan to sell some important businesses, and formed or plan to form joint ventures. Du Pont formed a multi-million-dollar pharmaceutical joint venture with Merck; Grace plans to spin off its organic chemicals business; Hercules will form a flavors joint venture with Imcera's Fries & Fries unit; Olin has reached agreements to sell a number of small chemical businesses; and Carbide has formed a joint venture with Mitsubishi to operate its graphite business and recently announced the spin-off of its industrial gases division into an independent company.

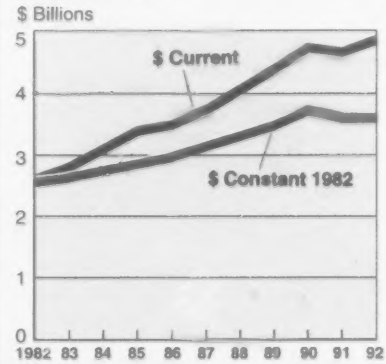
The R&D dollars devoted to a sold or joint-venture operation can no longer be included in a company's account of R&D. Also, few have made acquisitions to balance both the revenues and R&D commitments lost.

Although companies sell and shuffle around their businesses even in the best of times, those actions can have a strong impact on the R&D data they report. For instance, Du Pont's 1991 data exclude Du Pont pharmaceutical R&D because of the formation of the Du Pont Merck Pharmaceutical joint venture as of January 1991. Had Du Pont been able to include pharmaceutical research in 1991 data, a Du Pont spokesman says that the average increase last year over the previous year would have been 6%. (The other 14 companies showed an average 2% increase in R&D in 1991 compared with 1990.)

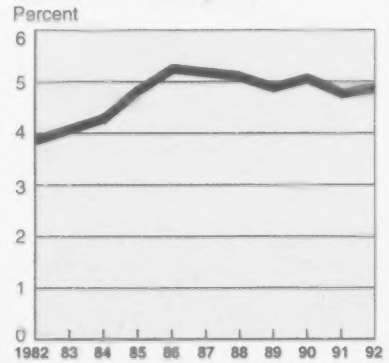
Even among the diversified companies in C&EN's survey, individual companies' changes in fortune have a measurable impact on the group's R&D spending. IBM's well-known sales and competitive problems forced the giant to cut its budget to $6.5 billion in 1990 from $6.8 billion in 1989, causing the table of diversified companies to show a 1% average decline in 1990. IBM's subsequent R&D budget drop in 1991 to $6 billion further limited the diversified group's increase to 4% in that year and to a projected 1% for 1992. On the other hand, AT&T's purchase of NCR added significantly to its 1991 R&D budget of $3.1 billion. Without it the 1991 average increase for the diversified group of companies would have been much lower.

The economic upheavals affecting so many individual companies are bound to have an effect on future-oriented growth and development for the chemical industry. C&EN projects that R&D as a percentage of future-oriented

**R&D spending is projected to increase . . .**




**. . . and also to rise as percent of company sales**




**Note:** For 15 companies listed on page 11. **Sources:** C&EN surveys and estimates, Battelle

**R&D down as percent of future-oriented spending**

**Note:** Based on C&EN surveys and estimates of 12 major chemical companies listed on page 11 (Arco Chemical, Lubrizol, and Petrolite are excluded because they were not included in the 1991 capital spending survey).

spending (combined R&D and capital expenditures) will decline one percentage point in 1992 compared with 1991 to 34%. The data are derived from a group of 12 companies for which C&EN tracks both capital and R&D expenditures. The 10-year high for the group was in 1987, just as the chemical industry experienced a boom in sales and profits spanning 1986 to 1988. In 1987, R&D as a percentage of future-oriented spending was 39%.

Still, in these relative terms, R&D in 1992 will not drop anywhere near the 10-year low of 29% of future-oriented spending in 1982, during the last most serious recession. This year actually promises a recovery in R&D spending for the 15 chemical firms surveyed and the chemical industry as a whole. The Chemical Manufacturers Association projects a 5% increase in chemical-related R&D spending in its recent survey of member companies, compared with C&EN's projected 4% increase. Both of these forecasts are higher than Battelle's forecast of a 3.2% increase to $80.5 billion for all industry R&D spending in 1992. The Columbus, Ohio-based research organization also estimates that all industry spending after inflation will show a real increase of less than 1% compared with a real increase of nearly 2% when its inflation data are applied to C&EN's survey results.

Jules J. Duga, senior R&D policy analyst for Battelle, argues that as corporate profits suffer, industry sees R&D as a candidate for short-term curtailment. As a result, R&D directors are putting more emphasis on short-term research projects where they can make a case for R&D's impact on profits. In Duga's opinion, "The environment that permits greater rewards for short-term financial results, rather than technological innovation, will continue to have an adverse effect on R&D investment."

Petrolite's vice president of technology, Ralph J. Churchill, makes a convincing argument for R&D directed at satisfying immediate customer needs. "To service our customers in today's market we feel there is more need to fund field support than research." Churchill says Petrolite has begun to view itself as a service company. "People are paying us for the performance of our products, not for a specific chemistry," he says.

Churchill notes that Petrolite has renamed its R&D department a technology department, because the latter term "encompasses more than the development of new products." He says the company has not given up its basic research, but has put more effort into applying that research to customer needs. The company defines R&D as basic research—it does not include technical support and field assistance to customers in the R&D numbers it reports. As a result, the company's R&D budget has moved in a narrow range between $11 million and $13 million since 1983. But Petrolite's expenses for technical assistance in support of its customers has ranged from $20 million to $21 million for the past several years, says Churchill. In 1992, the company plans to devote $23 million to technical assistance.

The reorientation of R&D spending in direct support of customers is not a new movement among the nation's chemical companies. Companies emphasize the reorientation only because they must show they are making efforts to bolster profitability in a difficult economy. Battelle's Duga says the economic pressures on R&D directors has made them keenly aware, on the one hand, of the requirement to satisfy the need for R&D that aids corporate sales, and on the other, of the need to conduct the sort of "R&D investment necessary for long-term profit and survival."

Dow Chemical's vice president of R&D, Fred P. Corson, notes that all of Dow's research "has some target for commercial opportunity," though he admits the targets are not always achieved. About 20% of Dow's R&D effort in the company's core basic, industrial, and specialty chemicals, and in its plastics businesses, is aimed at developing new technology for new product lines—the type of R&D that Duga would say is necessary for long-term profit and survival. The remaining 80% goes to support and expand existing businesses with process support and product research leading to product line extensions.

Whether Dow or Petrolite have found a good balance for their respective R&D budgets is another question. But how these and other chemical companies decide to fund and increase their R&D efforts is bound to have an impact on the bottom line. As it appears now, chemical R&D growth is modest and may remain modest in the future until chemical industry sales and profits improve or the government changes the rules affecting R&D tax credits.

Therefore, significant growth in dollars directed at either serving customers or developing the brand new products necessary for long-term survival, may come if the U.S. government decides soon to extend R&D tax credits permanently. Many in the research community are hoping that President Bush's budget proposals expected later this month will contain such a permanent tax credit. According to Kenneth R. Kay, executive director of the Council on Research & Technology (Coretech), a 20% credit on increases in R&D spending is scheduled to expire by midyear. Coretech is a Washington, D.C.-based coalition of companies and universities committed to promoting a strong U.S. R&D policy, says Kay.

As it exists now, Kay points out, the tax credit boosts U.S. R&D spending 6

## Major chemical companies plan 4% rise in R&D spending this year

| $ Millions | Planned 1992 | Actual 1991 | Planned 1991 | 1990 | 1989 | 1988 | 1987 | 1986 | Change from previous year 1992 | Change from previous year 1991 | R&D spending as % of sales 1992 | R&D spending as % of sales 1991 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CHEMICAL COMPANIES | | | | | | | | | | | | |
| Air Products[a] | $ 85 | $ 80 | $ 79 | $ 72 | $ 71 | $ 72 | $ 57 | $ 61 | 6.3% | 11.1% | 2.7% | 2.7% |
| American Cyanamid | 540 | 480 | 479 | 461 | 407 | 365 | 314 | 278 | 12.5 | 4.1 | 11.0 | 10.2 |
| Arco Chemical | 63 | 60 | na | 59 | 52 | 39 | 29 | 32 | 5.0 | 1.7 | 2.1 | 2.1 |
| Dow Chemical | 1230 | 1,160 | 1180 | 1,136 | 873 | 772 | 670 | 605 | 6.0 | 2.1 | 5.8 | 5.7 |
| Du Pont[b] | 1237 | 1,245 | 1220 | 1,428 | 1,387 | 1,319 | 1,223 | 1,156 | -0.6 | -12.8 | 5.2 | 5.4 |
| Ethyl[c] | 69 | 69 | 68 | 65 | 61 | 59 | 50 | 47 | 0 | 6.2 | 2.6 | 2.7 |
| W. R. Grace | 153 | 150 | 150 | 148 | 125 | 119 | 107 | 94 | 2.0 | 1.4 | 2.1 | 2.2 |
| Hercules | na | 86 | na | 92 | 79 | 74 | 74 | 71 | na | -6.5 | na | 2.6 |
| Lubrizol | 86 | 79 | na | 74 | 70 | 65 | 62 | 51 | 8.9 | 6.8 | 5.5 | 5.3 |
| Monsanto | na | 640 | na | 612 | 598 | 575 | 557 | 523 | na | 4.6 | na | 6.9 |
| Olin | 50 | 50 | na | 66 | 66 | 58 | 62 | 56 | 0 | -24.2 | 1.8 | 1.9 |
| Petrolite[d] | 13 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 18.2 | -8.3 | 4.0 | 3.6 |
| PPG Industries | 225 | 225 | 250 | 236 | 249 | 239 | 227 | 204 | 0 | -4.7 | 3.5 | 3.6 |
| Rohm & Haas | 195 | 185 | 185 | 178 | 175 | 156 | 142 | 133 | 5.4 | 3.9 | 6.4 | 6.4 |
| Union Carbide | na | 190 | 200 | 191 | 181 | 159 | 159 | 148 | na | -0.5 | na | 2.4 |
| **TOTAL** | **$3946** | **$ 4,710** | **$3823** | **$ 4,830** | **$ 4,406** | **$ 4,083** | **$ 3,745** | **$ 3,471** | | | **4.9%** | **4.8%** |
| **ANNUAL CHANGE[e]** | **4%** | **-2%** | | **10%** | **8%** | **9%** | **8%** | **2%** | | | | |
| DIVERSIFIED COMPANIES | | | | | | | | | | | | |
| Allied-Signal[f] | 650 | 650 | 700 | 721 | 603 | 647 | 667 | 734 | 0 | -9.8 | 4.9 | 5.1 |
| AT&T Bell Labs | na | 3,100 | na | 2,433 | 2,652 | 2572 | 2,453 | 2,278 | na | 27.4 | na | 8.1 |
| Eli Lilly | na | 800 | na | 703 | 605 | 512 | 466 | 427 | [illegible] | 13.8 | na | 15.0 |
| FMC | 140 | 136 | 140 | 158 | 150 | 144 | 132 | 146 | 2.9 | -13.9 | 3.5 | 3.5 |
| IBM | 6000 | 6,000 | na | 6,500 | 6,827 | 5,925 | 5,430 | 5,221 | 0 | -7.7 | 8.1 | 8.4 |
| Merck & Co. | na | 1,000 | na | 854 | 751 | 669 | 566 | 480 | na | 17.1 | na | 12.7 |
| Morton International[f,g] | 60 | 59 | 60 | 48 | 38 | 35 | 31 | 29 | 1.7 | 22.9 | 3.0 | 3.1 |
| Procter & Gamble[g] | na | 786 | na | 693 | 628 | 615 | 549 | 479 | na | 13.4 | na | 2.9 |
| Schering-Plough | 480 | 425 | 420 | 380 | 327 | 298 | 251 | 212 | 12.9 | 11.8 | 13.5 | 12.4 |
| **TOTAL** | **$7330** | **$12,956** | **$1320** | **$12,490** | **$12,581** | **$11,417** | **$10,545** | **$10,006** | | | **7.6%** | **7.5%** |
| **ANNUAL CHANGE[e]** | **1%** | **4%** | | **-1%** | **10%** | **8%** | **5%** | **13%** | | | | |

**a** Fiscal year ends Sept. 30. **b** All figures exclude Conoco. 1991 and 1992 figures exclude pharmaceutical research now part of Du Pont Merck Pharmaceutical Co. **c** 1989, 1990, 1991, and 1992 figures adjusted to reflect spin-off of Tredegar Industries in July 1989. **d** Fiscal year ends Oct. 31. **e** For those companies reporting. **f** Includes all company-financed R&D but excludes contract R&D. **g** Fiscal year ends June 30. **na** = not available.

to 8% beyond what private sources would otherwise commit to R&D. Of the $60 billion he says is spent on privately funded R&D in the U.S., the tax credit returns $1 billion to industry, but in so doing, results in a net increase of $4 billion directed to R&D. Coretech would like to see Congress and the Administration make the tax credit permanent, instead of extending its provisions for six months to a year at a time. This would go a long way toward increasing R&D spending, he says, because companies could plan their R&D budgets mindful of the credit on increased R&D spending.

Dow's Corson says the R&D tax credit "must be long term and stable to give us an incentive" to increase R&D. Short-term renewals make it "impossible to make a decision based on short-term tax law," and "in no way influences the amount we spend on R&D."

Robert B. Hill, associate director of taxation for the Chemical Manufacturers Association, says CMA would support a proposal to make the R&D tax credit a permanent feature of the tax code. In addition, CMA also would like Congress and the Administration to make permanent a rule that allows U.S. companies with foreign sales to take a credit for some, but not all, of the increase in their domestic R&D that might otherwise be denied because it supports overseas sales. Hill argues that the credit to domestic research that aids overseas sales not only would benefit the growth of U.S.-based research, but also would help maintain the U.S. chemical industry's stature as the world's largest chemical exporter.

In fact, says Corson, Dow would "be happier with a lower credit" on total R&D instead of just on the increase. If that were to happen, adds Corson, Dow "would probably do even more R&D in the U.S." Coretech's Kay says that such a blanket credit is unlikely to happen, though "from a policy perspective, Dow is right." Kay believes industry would go along with the permanent tax credit for R&D increases and a reasonable rule on the treatment of domestic R&D allocated to overseas sales. Congress, he thinks, would go along with a permanent limited tax credit, but not with a credit on all privately funded R&D because of the cost to taxpayers. □

# Modest growth forecast for European chemicals

According to Richard Freeman, chief economist of ICI in the U.K., "1992 is expected to be a better year for the industry than 1991—but that's not saying very much."

As chairman of the economic appraisal committee for the U.K.'s Chemical Industries Association (CIA) and of the economic outlook working party of CEFIC, the European Chemical Industry Council, in Brussels, Freeman had little encouraging news for CIA's seventh annual Business Outlook Conference in London earlier this month. On tap for the year: "slow recovery" for the U.K. chemical industry, a report echoing the "slight improvement" predicted by CEFIC economists for the Western European industry in 1992.

CEFIC's forecasts, compiled at the end of November, indicate a 2% growth in production over 1991 for the European chemical industry. However, such growth assumes a considerable increase in exports. "In view of the weakness of the U.S. economy, slower growth in Japan, and weak growth in Europe itself, there is some doubt that the forecast can be achieved," CIA cautions.

After a flat year, compared with 1990, the U.K.'s chemical industry is looking for production to grow 2% this year, Freeman says. In other Western European countries, chemical production is also weak, with no sign of any recovery. Even in Germany, which avoided recession earlier as production boomed to meet the strong demand caused by unification, chemical production is slowing. Germany's chemical industry had a strong first half in 1991, but production began falling in the second half. Very little growth is expected in the first half of 1992, and the second half is predicted to be flat or show just a little growth in production.

Last year, most of CEFIC's member countries were expecting an acceleration in exports and a deceleration in imports of chemicals. In fact, the reverse occurred. "They have made the same mistake for 1992," Freeman says. For example, for 1992, exports are forecast to accelerate from 1.4% to 3.3% over last year. Import growth is also expected to accelerate—from 3.9% to 4.5%.

The forecasts for chemical demand show considerable differences among countries. The growth in demand in Germany is expected to slow down sharply, and is forecast to weaken slightly in Belgium. A strong pickup in the growth rate is forecast in Spain. However, CIA believes that the chemical demand forecasts are also on the high side, and probably will not make the 2.6% growth predicted. As Freeman points out, "Whatever happens this year, there can be no doubt that the general economic background for the chemical industry in 1992 is less than buoyant."

## Outlook for chemicals upbeat despite dismal 1991

| % change in chemical production | 1989–90 (actual) | 1990–91 January 1991 forecast | 1990–91 December 1991 revised forecast | 1991–92 (forecast) |
|---|---|---|---|---|
| Belgium | 5.5% | 4.0% | 0.5% | 3.4% |
| France | 1.3 | 2.5 | 2.1 | 3.0 |
| Germany | 2.0 | 2.0 | 2.5 | 2.5 |
| Netherlands | 1.5 | 2.0 | −2.0 | 0 |
| Italy | 1.5 | 0.4 | −1.5 | 1.5 |
| Spain | 3.5 | 3.0 | −3.0 | 2.0 |
| U.K. | 0.6 | −1.0 | 0 | 2.0 |
| TOTAL[a] | 2.0% | 2.0% | 0.3% | 2.0% |

[a] For all of Western Europe. **Source:** European Chemical Industry Council (CEFIC)

The fall in profits in 1991 and the relatively weak demand outlook for 1992 are again expected to constrain capital spending by the industry in most countries, after cuts in spending in 1991 from 1990.

In the U.K., for example, companies cut back capital expenditures 15% from levels in 1990, compared with a drop predicted a year ago of 10%. Continuing weak demand is likely to see another sharp fall in spending by the U.K. chemical industry this year—about 6% in volume. Total Western European chemical capital spending fell about 2% in real terms in 1991, and a further fall of about the same amount is expected this year. Large declines are forecast in Belgium and the Netherlands, and spending probably also will decline in France and Italy, or be flat at best.

Chemical employment is forecast to be flat or to fall about 2% (Belgium and Spain are the exception, with chemical employment in these two countries expected to show some expansion).

Looking specifically at U.K. chemical industry performance, Freeman reports that production was flat in 1991, an "improvement" on the 1% drop from 1990 production CIA predicted a year ago. Some of that may be statistical confusion, however; "given the state of the statistics, it would not be surprising to see the index revised down to a fall of 1%" after all, he says. Imports were up 1%, exports up 3.5%, and domestic demand down 1.5%.

According to the CIA economics panel, the reason the U.K. industry held at least flat was almost entirely because of the strength of the pharmaceuticals industry—without that, production would have fallen 2.5%. For this year, output in the U.K. is expected to grow about 2%—a figure that has been revised downward from 2.5% just since late November because of continuing sluggishness in the U.K. economy—spurred by growth in pharmaceuticals, and by some recovery in paints, dyes, and plastics.

A glimmer of hope of recovery for the U.K. industry also comes from David Ingles, senior chemicals analyst at London-based stockbrokers James Capel. "Although 1992 will be a difficult year, there are some reasons to believe that improvements will start this year," he says.

These reasons include:

- People tend to concentrate on petrochemicals and plastics, but these make up only 37% of the global industry—other sectors are more recession-resistant and less cyclical, and currently more profitable to producers.
- Company balance sheets generally are in good shape, cash-rich, for example, or showing debt-to-equity ratios of a healthy less than 50%.
- Perhaps most important, unit labor costs have fallen at chemical companies—productivity is rising sharply, even though output is down or flat. "Improvements are coming through already, so that when output picks up, there will be a useful positive contribution to profits," Ingles says. "There is reason to believe the worst is over, as far as company profits are concerned."

*Patricia Layman*

C&EN staff photo

# SOAPS & DETERGENTS

**Susan J. Ainsworth**, C&EN Houston

The recession and growing public concern over the environment are two factors that now figure into virtually every move made by U.S. soap and detergent manufacturers and their suppliers.

Of more concern than any particular piece of legislation affecting the soap and detergent industry, "the 'green' movement is really the major concern down the road," says J. G. (Jim) Johnson Jr., business manager for α-olefins at Chevron Chemical, Houston, referring to increasing environmental issues. "Everyone in the industry is sensitive to that," adds George Elling, market development manager for Union Carbide's surfactant business. End users "want to work with environmentally safe products."

Concern about the environment is leading the industry to develop environmentally sensitive products, which are increasingly being sold in recycled packaging material to meet regulatory requirements and satisfy consumer demand, according to a Department of Commerce report, "Cleaning Preparations and Cosmetics," released this month. A case in point: In recent years the industry has turned to concentrated detergents that are both more powerful and require less packaging material.

Environmental developments as well as changing consumer needs will create global demand during 1992 for new functional raw materials that improve the performance of detergent products, says Kenneth F. Schoene, director of performance chemicals for BASF Corp. "As a result, the role of surfactants, polymers, and other additives in laundry and cleaning products will become more critical, with formulations evolving at an increased rate," he says.

In addition, companies that supply the soap and detergent industry are being called upon to prove that the ingredients they have been supplying are indeed environmentally sound enough to continue in their roles.

The upshot is that more research and development will be needed to meet both domestic and global competition and proliferating environmental regulations, according to the Commerce report. Those companies that can come up with the products that will help their customers deal with these immediate market challenges will likely come out on top.

Given the twin pressures of the recession and the green movement, it's no surprise that the soap and detergent industry did not have a year worth bragging about. The value of industry shipments of soaps and detergents increased only 3.2% to more than $14 billion in 1991, according to Commerce. In constant dollars, growth was only 2.7% above 1990.

Delayed introductions of new products because of the general recessionary period may have been one factor limiting industry growth this year, notes Nicholas C. Fanandakis, market manager for cleaning products at Du Pont. And because the economy continues to suffer, "you may find companies who will delay launches planned

in 1992 until the end of this year or push them into 1993."

What little growth there was in 1991 is attributed to the laundry detergent market, both in domestic and export shipments. The Department of Commerce estimates that exports of soaps and detergents in 1991 increased 25% to $487 million, and imports fell 4%. Increased automation is one factor that has given the U.S. industry a competitive edge in global markets.

As 1992 begins, raw material suppliers say they are really no better off than they were at this time last year. "Twelve months ago we were facing the threat of war in the Persian Gulf. Feedstock [prices] had skyrocketed, placing pressure on surfactant pricing. Twelve months later, the war has ended, we are in economic recession, and we are facing the same pressures we did one year ago. Feedstock prices are going up once again, placing pressure on surfactant pricing," says W. Jan B. Vogel, vice president for surfactants at Vista Chemical in Houston.

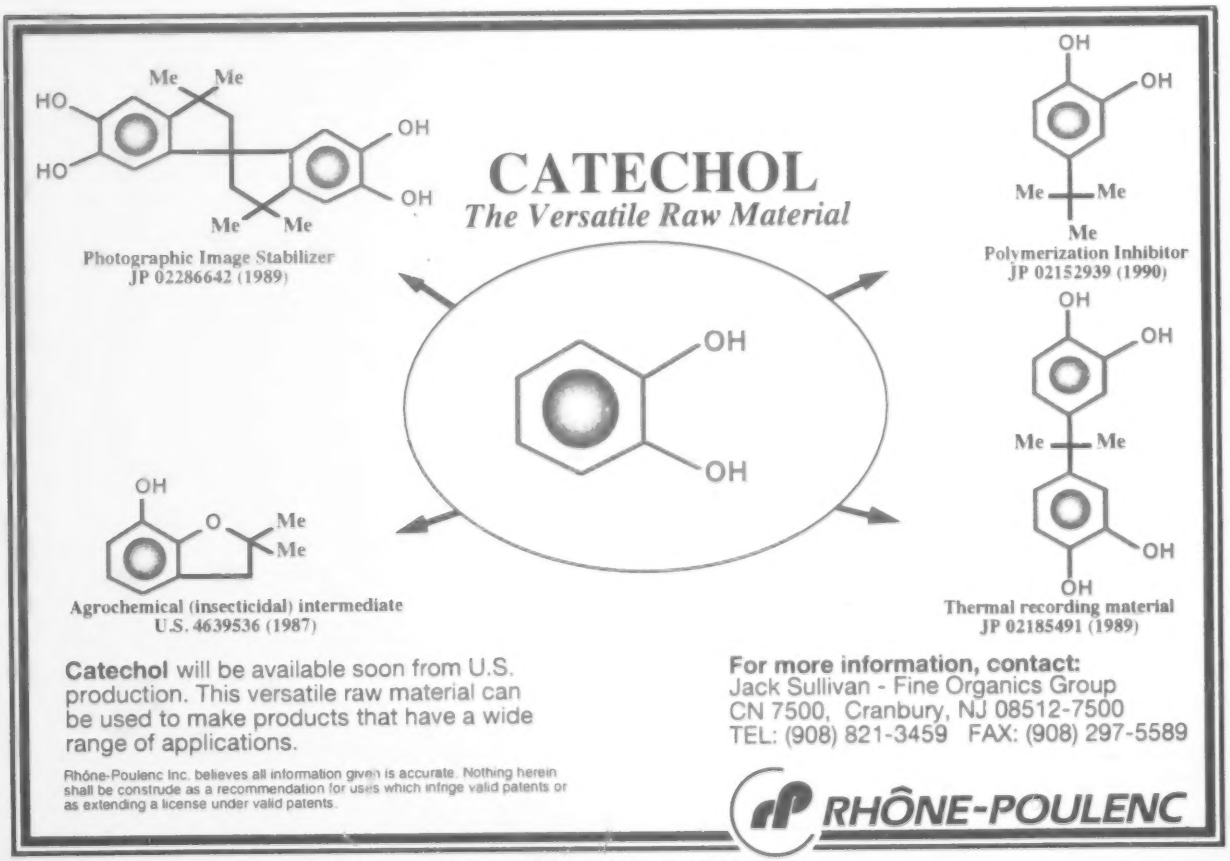
Du Pont's Fanandakis agrees: "I think that in general the recession has impacted businesses to the point of probably making it about equal to what it was in the prior year." For Carbide, however, Elling says business held up reasonably well in 1991. "The difference is that without the recession, we would be seeing substantial growth rather than just modest growth."

The forecast is slightly sunnier for 1992. In constant dollars, industry shipments are forecast to increase 3.7%, according to the Department of Commerce. In real terms, industry shipments are expected to increase from 2.5 to 3% per year well into the 1990s.

The companies that will fare best in 1992 are those that develop and market more environmentally safe, "greener-type" products that are somehow "revolutionary," says Fanandakis. He notes that Du Pont "is working on some next-generation-type products for soap and detergents that would fill the needs of current products." But he says the company, which supplies a number of specialty products such as perborates, potassium monopersulfate, and hydroxy acetic acid to the soap and detergent industry, is not yet ready to unveil these new offerings. And he declines to say whether they are targeted for the "more environmentally friendly" niche.

Indeed, soap and detergent producers are less concerned about getting their hands on lower cost raw materials than they are about securing materials that are environmentally sound. "The emphasis is not on 'give it to me cheaper,' but rather on supplying products that are environmentally safe and that perform certainly as well as if not better than competing products," says Fanandakis. "In fact, if you are supplying that need, in some cases, the customer is willing to pay more for an environmental product."

Although the need for improved, environmentally friendly products will be global in scale, some regions of the world are likely to require specific functional molecules to satisfy local



CATECHOL
The Versatile Raw Material
Photographic Image Stabilizer
JP 02286642 (1989)
Polymerization Inhibitor
JP 02152939 (1990)
Agrochemical (insecticidal) intermediate
U.S. 4639536 (1987)
Thermal recording material
JP 02185491 (1989)
Catechol will be available soon from U.S. production. This versatile raw material can be used to make products that have a wide range of applications.
For more information, contact:
Jack Sullivan - Fine Organics Group
CN 7500, Cranbury, NJ 08512-7500
TEL: (908) 821-3459 FAX: (908) 297-5589
Rhône-Poulenc Inc. believes all information given is accurate. Nothing herein shall be construde as a recommendation for uses which infrige valid patents or as extending a license under valid patents.
RHÔNE-POULENC
CIRCLE 38 ON READER SERVICE CARD

needs. "Accordingly, BASF is putting added emphasis on utilizing its global resources to develop new raw materials and applications for the detergent industry that will meet increasingly stringent performance and environmental requirements," says Schoene.

Utilizing "world industry-segment teams," BASF is developing new products and application data aimed at meeting customer needs of the future, he says. "Research and development resources are being focused on new products and applications for surfactants and polymers. Combinations of Pluronic and Plurafac surfactants with Sokalan carboxylated polymers, for example, have been found to give oil-specific detergency advantages in laundry and hard surface cleaning formulations.

Schoene reports that U.S. production capacity for Sokalan homo- and copolymers, a multifunctional line of polycarboxylated dispersants for use in detergents and cleaning products, has been expanded in Spartanburg, S.C., to satisfy increasing customer needs in North America. Sokalan polymers can act as primary and secondary detergency boosters, processing aids, and powder detergent particle modifiers depending on polymer structure and molecular weight. These polymeric detergent additives also are being manufactured at multiple sites worldwide by BASF and will help facilitate the development of new detergent products, including multifunctional and highly concentrated formulations, Schoene adds.

*BASF worker analyzes detergent formulation*

Superconcentrates or concentrated detergents—which continue to be the biggest marketing trend in the soaps and detergents industry—are shining examples of the great potential of products marketed as environmentally stable and friendly. "Concentrated detergents address many of today's key issues including environmental awareness. Compact detergents use less packaging material and also eliminate some filler ingredients, so the impact on the environment is reduced. This appeals to consumers by enabling them to purchase environmental friendly products without sacrificing performance or convenience,"

PRODUCT PROSPECTUS

**Quickly Identify Unknown Gases and Vapors On-the-Spot**

**The Deluxe HazMat Kit**

The new HazMat kit is portable, accurate and easy to operate. Qualitative analysis is performed with just two detector tubes–one for organic compounds and one for inorganic compounds. Results are obtained through a color change of the test reagent media, avoiding the need for expensive lab tests. *Complete details about Deluxe HazMat Kit are available free.*

Technical Help Line 1-800-544-1658

Matheson Gas Products
World Leader in Specialty Gases & Equipment

30 Seaview Drive
Secaucus, NJ 07096-1587

CIRCLE 34 ON READER SERVICE CARD

**CESIUM**

**Cs** It's not just for catalysts anymore.

**Cabot wants to meet your Cesium needs. Call us for purity, pricing and delivery information.**

**Cesium Acetate • Cesium Bromide**
**Cesium Carbonate • Cesium Chloride**
**Cesium Chromate • Cesium Fluoride**
**Cesium Formate • Cesium Hydroxide**
**Cesium Iodide • Cesium Metal**
**Cesium Nitrate • Cesium Oxide**
**Cesium Perchlorate • Cesium Sulfate**
**Other compounds available upon request.**

**Manufactured in Revere, Pennsylvania by:**

(800) 531-3677 PA
(800) 531-3676
(215) 367-1500
300 Holly Rd., P.O. Box 1607
Boyertown, PA 19512-1607

CABOT

CIRCLE 8 ON READER SERVICE CARD

**A New Parr Catalog**

The complete line of Parr Laboratory Reactors and Pressure Vessels is described in a new, 118-page Reactor Catalog. In addition to full coverage of all Parr stirred and non-stirred pressure vessels, this enlarged Seventh Edition contains new listings of the many optional stirrers, heaters, solids charging systems, catalyst holders, condensers, windows and other attachments which can be added to Parr laboratory vessels. The catalog also describes a new high precision temperature and process controller.

Copies are available on request. Call or write for your free copy.

Parr INSTRUMENT COMPANY
211 Fifty-third Street • Moline, IL 61265
Phone: 309-762-7716 • 800-872-7720
Fax: 309-762-9453 • Telex: 270226

CIRCLE 16 ON READER SERVICE CARD

Air Products'

**SFC/SFE Grade $CO_2$**

- Guaranteed performance for FID, ECD, and NPD detection
- Integral liquid level cylinder valve
- Optional helium head (1800psi)
- Performance chromatograms and connecting/trouble-shooting guidelines supplied with each shipment

**Call for More Information**
**1-800-752-1597**

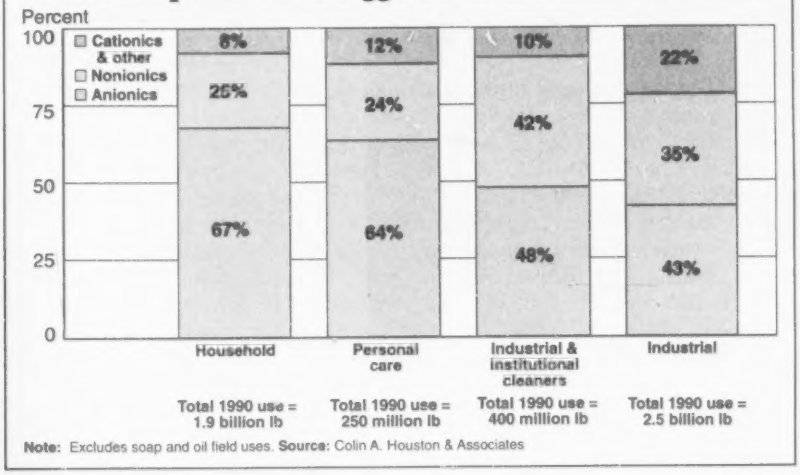
AIR PRODUCTS

Optimal results, time after time

320-9214



**Household products are biggest user of anionic surfactants**




**Note:** Excludes soap and oil field uses. **Source:** Colin A. Houston & Associates

explains Vista's Vogel. "We believe that concentrates will continue to be the trend in 1992," he says.

Compact detergents are a favorable trend for Vista. They "use the same major surfactants being used in conventional laundry powders and liquids in the U.S. today, which are linear alkyl benzene (LAB) and surfactant alcohol derivatives. Vista produces LAB, surfactant alcohols, and alcohol ethoxylates, so we will continue to supply these materials in concentrated detergents," adds Vogel.

In anticipation of the move toward concentrated liquid detergents, Vista has developed proprietary technology in the formulation of low-water concentrated laundry liquids that contain linear alkylbenzene sulfonates (LAS). "The most important property of this formulation is that it allows enzymes to remain remarkably stable without the use of added stabilizers."

In addition to the successful introduction of concentrated home laundry detergents throughout the U.S. during 1991, national and regional detergent manufacturers are now focused on work to add peroxygen bleach to their home laundry products, according to Frank E. Caropreso, FMC's detergent industry manager for peroxygens.

Another trend, related to automatic dishwashing detergents, is surfacing, but suppliers are mixed on how big a splash it will make. In the U.S. in 1991, the industry has shifted its focus for 1992 to commercializing liquid automatic dishwashing gels, says Peter P. Carfagno, detergents products technology manager at FMC's R&D labs in Princeton, N.J. Du Pont's Fanandakis says "I guess I don't see this as a revolutionary trend that one could equate to superconcentrates." Automatic dishwasher gels probably won't grow to be as big a trend as superconcentrates, certainly not in 1992, he says, "considering how long it took concentrates to get to where they are in the U.S. now."

But, to be sure, in the consumer market, gels are emerging as a significant new product. Gels offer improved dispensing advantages over the first-generation liquid dishwasher detergents, which are best described as slurries. The early liquids could separate and layer in the container. The gels contain more soluble ingredients, resulting in a more uniform and homogeneous product. These characteristics ensure easy dispensing from the container.

The key challenge in formulating gels is to achieve the desired solubility while balancing cost. To meet this hurdle, FMC developed improved phosphate materials through a balanced use of phosphate salts, according to Carfagno. The group worked with automatic dishwasher detergent formulators to improve the raw materials that would provide the cost and performance required.

"We have done a great deal of R&D in [automatic dishwasher] applications to develop improved materials, and our researchers know the technology of developing phosphate systems to formulate products exhibiting superior cost-performance characteristics," Car-

CIRCLE 55 ON READER SERVICE CARD

## Environmental concerns continue to erode phosphates market

The controversy over the use of phosphates in detergent products has been raging on for almost three decades now. In the 1990s, as environmental concerns become more and more important, the discussion of this issue will remain critical to environmentally conscious consumers and manufacturers.

Phosphates are used in some detergents as the sequestering builder that can inactivate hard water minerals (primarily calcium and magnesium) and hold them in solution. This increases the efficiency of the surfactant. In addition, phosphates furnish the necessary alkalinity for cleaning. They keep the dirt particles in suspension, helping prevent the particles from being redeposited on garments or dishes. In addition, they emulsify oily and greasy soils.

Phosphates are popular builders because of their effectiveness, reasonable cost, and safety for use with appliances, fabrics, and humans. They are nontoxic to aquatic life as well, says the Soap & Detergent Association (SDA).

The problem is that in combination with other nutrients like carbon, nitrogen, and potassium, for example, phosphates nourish algae and plant growth in lakes and streams. This process of fertilization, called eutrophication, occurs naturally but is speeded up as the population contributes waste to water. Lack of oxygen for fish is one of the consequences of the eutrophication of water.

Only about 25 to 30% of the phosphorus in wastewater comes from laundry detergents, with the remainder coming from human waste and food waste; and detergents contribute only 3% of the phosphorus annually entering U.S. surface waters, according to SDA. "Nevertheless, one way legislators have dealt with the localized problems of eutrophication is to ban or restrict the amount of phosphate in detergents," adds the association.

Although federal legislation aimed at banning or restricting phosphates in laundry detergents or automatic dishwasher detergents has been proposed, none has been enacted to date. All activity has been at the state and local level.

No state has banned phosphate use in automatic dishwashing detergents and where regulated the amount of phosphate allowed is generally no lower than 8.7%, according to SDA. In addition, in the past decade many ADD manufacturers have voluntarily cut the amount of phosphate (expressed as phosphorus) used in their products from a high of about 14 to 16% by weight to 8.7% or less today. Light-duty dishwashing liquids do not contain any builders, so no phosphates are present.

Phosphates used in laundry products have been more highly regulated. There are statewide bans in Georgia, Indiana, Maryland, Michigan, Minnesota, New York, North Carolina, Pennsylvania, Vermont, Virginia, and Wisconsin. In addition, bans are in force in some counties of Idaho, Montana, and Ohio; and in the municipalities of Chicago; Akron; Washington, D.C.; Portland, Ore.; Spokane, Wash.; and smaller communities in Illinois, New Hampshire, and Idaho. In addition, restrictions limiting the use of phosphate in laundry detergents to 8.7% and/or 7 g per use are in effect in Maine, Connecticut, and Florida. Further restrictive legislation is possible in the near future, since legislation has been introduced in several states.

In addition, many manufacturers have voluntarily pared down the phosphate content of most detergent formulations so that they contain no more than 8.7% phosphorus or 34% sodium tripolyphosphate (STPP), a principal builder that is still the standard of comparison for all other builders. [The exceptions are usually powder concentrates, which may contain up to 60% STPP (anhydrous basis) but are used

fagno adds. "The result is that the new [dishwasher] gels are unique in appearance; they are translucent. More importantly, they dispense beautifully with no sputtering. Sales and consumer acceptance of the new gels appears to be going well."

Companies are also at work to develop new surfactants. Ironically, although the recession and the increasing public concern for the environment are pinching companies involved in the soap and detergent industry, these two factors are also bolstering demand for certain surfactants. For example, more surfactants are needed to boost performance of products that lack builders such as phosphates, which are banned in many states.

In addition, more and different types of surfactants are required in formulating multifunctional products that consumers are demanding, according to a recent report by the Freedonia Group, a Cleveland-based consulting firm. These products combine fabric softeners, bleaches, enzymes, and antistatic agents into a single product, saving consumers money by shortening their cleaning products shopping list. However, multifunctional products frequently compromise properties such as cleaning and softening, when combined for consumer convenience. "Innovative surfactants, which are compatible with other ingredients, will provide opportunities for resourceful companies," the report says.

Increasing demand for nonirritating products, particularly shampoos and toiletries, but also household cleaners and light-duty hand dishwashing liquids, has spurred the development of gentler, yet effective surfactants. The increasing popularity of liquid personal soaps has also increased demand for synthetic surfactants, at the expense of natural soaps, adds the Freedonia report.

The increased consumer concern for reducing energy costs required for water heating has also led to changes in detergents. Lower wash temperature detergents require both more and different types of surfactants.

Given these trends, it's not surprising that surfactant shipments have outpaced the industry overall. They increased 5.9% to $3.3 billion in 1991, or 4.2% in constant dollars, according to the Department of Commerce. Exports increased 3.2% to $480 million, and imports increased to $140 million, producing a positive trade balance of nearly $341 million.

Still, the recession has forced manufacturers to keep a close watch on their costs to compete and protect their profit margins. And since raw materials are the most important cost behind soaps and detergents, they are the subject of the most scrutiny. Raw materials for soaps and detergents are derived from vegetable oil or animal fat or from petrochemical feedstocks. The raw materials are interchangeable and use is basically determined by cost of production, according to Vincent Kamenicky, an in-

in lower dosage levels in the wash-load. In fact, most laundry detergents containing STPP are designed to deliver 5.5 to 6.5 g of phosphorus per wash-load at recommended use levels.]

Indeed, these factors have put a crimp in U.S. demand for phosphates. In 1991, total estimated North American demand for all phosphorus-based products was expected to have exceeded 700,000 lb on a $P_4$ basis with exports remaining strong above the 140,000 lb level ($P_4$ basis), according to FMC. Total 1991 North American demand for STPP was slated to exceed 210,000 lb on a $P_4$ basis. Total exports of STPP for North America will exceed 40,000 lb on a $P_4$ basis.

Although the market for detergent phosphates is shrinking, it is still worthy of some investment. FMC, for example, has stepped up its participation in the market. Last spring, the company bought the phosphorus sales commitments of Occidental Chemical. In addition, the company continues to invest in R&D support for phosphates. For example, it is now installing new analytical technology at its Green River, Wyo., plant, which it claims is still the "the world's largest and lowest cost producer of STPP." The new technology will help "us to meet our customers' demands for higher levels of quality," says Peter P. Carfagno, FMC's detergents products technology manager.

Phosphorus is a core business for FMC, and the company continues to invest in both the Pocatello, Idaho, elemental phosphorus facility and the phosphate plants. FMC has also initiated improvement programs at the Carteret, N.J.; Lawrence, Kan.; Newark, Calif.; and Green River phosphate plants.

Capacity has substantially decline along with STPP demand in the home laundry market over the past 10 years and the exiting of the business by Olin and Occidental Chemical, according to Lesa Chittenden, marketing manager for cleaning compounds at FMC's phosphorus chemicals division.

From a domestic and worldwide standpoint, as STPP demand has declined, so has capacity. World STPP supply is shrinking, not only because of the exit of the two U.S. producers, but also because several producers around the world (in Japan, Europe, and South Africa) were expected to end production by year-end 1991. FMC says it does not predict significant reversal of this trend.

However, the rate at which product bans are being initiated has slowed, at least outside the U.S., says FMC. For example, in 1991 after consultation, the U.K. government announced that there should be no ban on phosphate use.

"The bottom line is that the number of worldwide phosphate producers and the amount produced will be declining over the next few years," says Daniel A. Corritore, export manager for FMC's phosphorus chemicals division. He expects phosphate supply and demand will be in balance over the next several years, given the additional capacity rationalizations and expected declines in demand. Worldwide production and consumption of STPP is about 2.5 million metric tons for 1991—the same as for 1990, he points out.

In 1992, FMC says it expects to see continued use of phosphates in home laundry detergents for the U.S. market. The export market for phosphates in home laundry detergents has also shown growth in Mexico and South America, says Chittenden.

However, the long-term outlook for phosphates and STPP is far from sunny. A recent SRI International report says that, "Although STPP's high performance characteristics have proved difficult to equal, its continued replacement appears likely, and it may totally disappear from U.S. laundry powders before the end of the century."

dustry specialist at the Department of Commerce.

Both sources have their pitfalls. Pricing of basic petrochemical feedstocks, including ethylene, benzene, and *n*-paraffins, are tied to fluctuations in the crude oil market. Prices and supplies of natural fats and oils, particularly coconut and palm oils, are highly cyclical and subject to wide price swings. Generally, producers can reformulate using either the petrochemical-based feeds or the renewable ones; the two can be interchangeable.

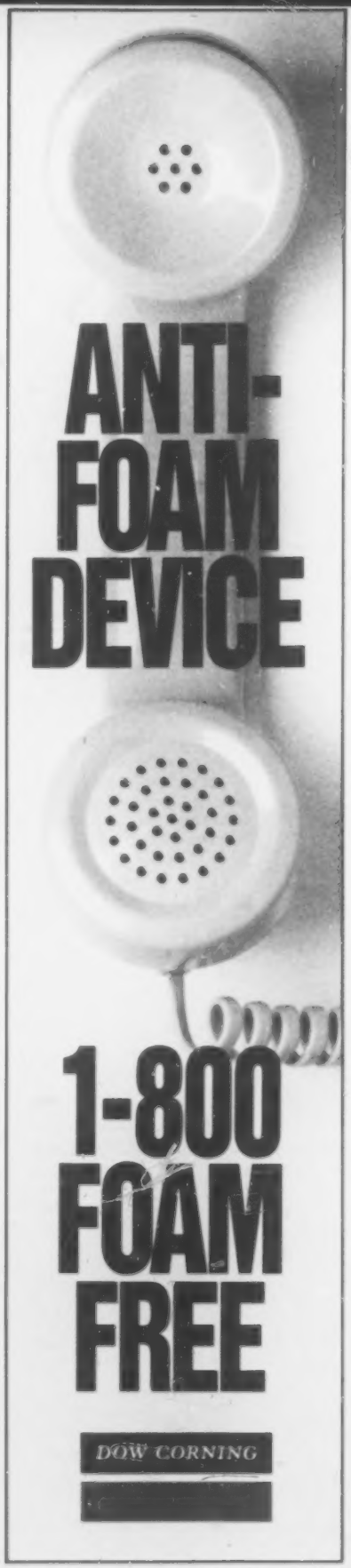
Many end users are taking a closer look at natural raw materials and products because they like the positive environmental message they present. "Natural soap production is taking hold and prospects are looking brighter," notes Kamenicky.

Like many in the industry, Chevron's Johnson says, "I don't see a performance difference between natural oils and synthetics." And producers of petrochemical-based feedstocks dispute that natural ingredients are better from an environmental standpoint. "It's more a perception than being more ecologically sound," he adds. But feeling these pressures, producers of petrochemical-based surfactant raw materials are scrambling to defend their offerings.

For example, Vista and Monsanto, the sole North American producers of LAB, which is sulfonated to produce LAS surfactants, teamed up recently to spread the word about their products' safety.

The two producers maintain that years of research and safe use confirm the environmental safety of LAS. It is one of the most widely tested detergent ingredients in use today, and has been examined under a variety of conditions to ensure that it has no significant effect on the environment, says Joseph C. Ledvina, director of environmental activities at Vista. Studies on LAS biodegradability show that it is rapidly and thoroughly degraded, and that it continues to degrade even in environments where oxygen is not present. These studies, coupled with real-world monitoring, confirm that LAS is not accumulating, despite increased use over the past three decades, and poses no threat to the environment, says James P. Mieure, product safety director at Monsanto.

LAS's highly effective cleaning properties and relative low cost have made it the most widely used surfactant for detergents worldwide, say the companies. It has also made it the subject of negative environmental claims by competitors. "As number one in its field, LAS is a target everyone else is shooting at to move into the same market," says Ledvina. "Green marketing is an angle our competitors are using now, and we don't want it to be forgotten that LAS is the original green product used to replace branched alkyl benzene (BAB), which was slow to degrade and caused a lot of visual and toxic problems."



CIRCLE 13 ON READER SERVICE CARD



## A summary of 1991 phosphate actions

■ CONNECTICUT
The Department of Environmental Protection testified at a March 1 hearing that it already had sufficient regulatory authority over water quality and did not need a bill that would amend the state's detergent law to ban the sale of all phosphate detergents. No action occurred on this bill.

■ LOUISIANA
No hearings were held on a bill introduced last spring that would empower the Department of Environmental Quality to regulate the phosphate content of "cleaning agents."

■ MASSACHUSETTS
Passed by the state Senate last spring, S. 50 was amended on the House floor in September and recommitted to the House Commerce & Labor Committee, where it currently resides. The bill would ban the use of phosphate in household laundry products, require regulatory review and approval for industrial and institutional exemptions, and impose broad ingredient reporting requirements on manufacturers of household cleansing products.

■ MONROE COUNTY, FLORIDA
In July, the Monroe County Commission approved phosphate ban amendments negotiated between the Soap & Detergent Association and the county attorney's office. The amended ordinance exempted from the county's phosphate ban all household and industrial and institutional automatic dishwasher products with a phosphorus measure of 1.1 g per tablespoon or less. It also provided for the continued use of all industiral dishwasher products for three months beyond the Oct. 19 effective date so as to allow for performance evaluation of lower phosphate products in such applications.

■ OREGON
This past summer the governor signed legislation limiting the use of phosphate in laundry detergents to 0.5% phosphorus by weight, and in automatic dishwasher detergents to 8.7% by weight, effective July 1, 1992. Industrial and institutional applications are exempt.

■ SOUTH CAROLINA
A phosphate ban bill passed by the legislature and signed by the governor in late May restricts phosphorus use in household laundry detergents to 0.5%, limits the automatic dishwasher detergent maximum to 8.7%, and provides for the traditional industrial and institutional exemptions, including commercial laundries.

■ TEXAS
In May, the city of Austin adopted an ordinance banning the use of phosphate in home laundry detergents with exemptions for automatic dishwashing and industrial and institutional products. Effective date is August 1992. Since then, La Grange, Smithville, and Wharton have adopted similar phosphate bans modeled after the Austin ordinance. All three become effective in fall 1992.

■ WASHINGTON
A phosphate ban bill died in committee last spring owing to lack of any scientific evidence that it would improve water quality.

■ FEDERAL
The Lakes Assessment & Protection Act of 1991, sponsored by Sen. George J. Mitchell (D.-Me.) would require the Environmental Protection Agency to establish a five-year phaseout of the use of phosphates in detergents. Introduced in May, the bill has not received priority attention.

Vogel explains, "Vista's history of manufacturing environmentally friendly surfactant raw materials dates back over 25 years. Vista was first to develop and commercialize linear detergent alkalate and linear synthetic Ziegler alcohols. Our linear detergent alkylate was used to replace 'hard' alkylate. Similarly, less biodegradable, nonionic surfactants were replaced with biodegradable surfactants based on linear alcohols. These environmentally friendly products are still widely used today."

In another move to defend the environmental profile of a product, a group of companies including Texaco Chemical and Union Carbide teamed up to do a study to demonstrate the environmental quality of alkylphenol ethoxylates, raw materials used in making laundry products and cleaners. The study, done in coordination with the Environmental Protection Agency, in-

volved 30 rivers and "found that these products are not building up in the environment. So people with environmental concerns about using them need no longer have these concerns," says Carbide's Elling. At the annual Soap & Detergent Association (SDA) meeting early next week, Carter G. Naylor of Texaco Chemical is slated to present the findings of the study in a paper entitled, "Alkylphenol Ethoxylates in the Environment."

Despite these concerns, Kamenicky expects to see growth in both synthetic and natural surfactant products in the near future. And, indeed, some of that growth in each sector will come from changes made to meet consumer demand for more environmentally friendly products. Reformulation, including the incorporation of biodegradable raw materials, will account for some synthetic growth, he says.

In 1992, the value of industry surfactant shipments is forecast to increase 5.1% in real terms, he estimates. Exports and imports are expected to increase as global concentration leads to fewer companies. Exports to developing countries will continue to grow, and imports from Western Europe also will post gains, adds Kamenicky. "The industry will continue to be affected by acquisitions and mergers. Environmental issues and concerns will dominate production with growth rates of 5 to 5.5% per year over the next five years," he adds.

Vista is one chemical company that remains "optimistic" about the prospects for 1992. Vogel reports the company has been experiencing "a continued increase in demand for all our products from many different market segments. We are anticipating another good year in LAB sales. In alcohol and derivatives, we anticipate ethoxylate sales for Vista in 1992 will outperform 1991."

C&EN staff photo

*Gel formulations are improving automatic dishwasher detergents*

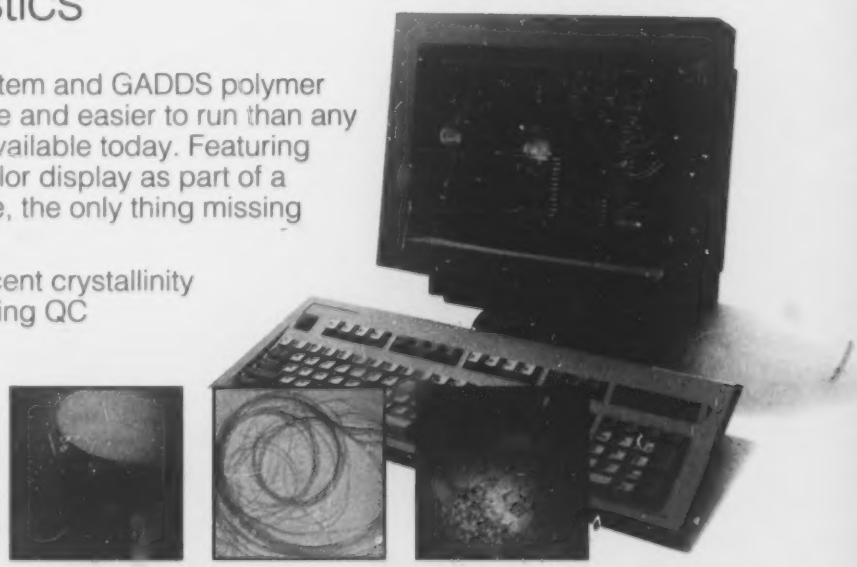
In the first of several steps that it is taking toward meeting increased customer demand, Vista recently completed the debottlenecking of the ethoxylation unit at its alcohol plant in Lake Charles, La. Capacity was increased from 65 million to 80 million lb per

SIEMENS

Finally – an easy-to-use X-ray diffraction system for analyzing plastics

The Siemens Area Detector system and GADDS polymer software are faster, more flexible and easier to run than any other X-ray diffraction system available today. Featuring pop-up menus and real-time color display as part of a graphics-oriented user interface, the only thing missing is competition.

- Ideal for texture analysis, percent crystallinity and other applications, including QC
- Easily measures d-spacings, angles and intensities from any pixel location
- Versatile data files can be used with powder diffraction software for phase identification and profile fitting



In USA & Canada contact: Siemens Analytical X-Ray Instruments, Inc. • 6300 Enterprise Lane • Madison, WI 53719 • (608) 276-3000
Worldwide contact: Siemens AG, Analytical Systems AUT V 371 • P.O. Box 21 1262 • D 7500 Karlsruhe 21 • Germany • (0721) 595-4295

CIRCLE 20 ON READER SERVICE CARD

year. In addition, says Vogel, "we are evaluating investment in LAB and alcohol capacity on a worldwide basis."

The inventory requirements for the rollout of new compact brands in 1992 will help Vista's sales, he anticipates. "And the improving economies of Latin America are also expected to provide a boost to our export business," says Vogel.

Chevron's Johnson is also sanguine about what 1992 holds for the α-olefins business as it relates to soap and detergent raw materials. "Rising ethylene prices is one factor that could really hurt those companies supplying petrochemical based feedstocks, by making way for natural oils," says Johnson. Chevron makes the key feedstocks used in the production of α-olefin sulfonates and fatty amine oxides. But that price rise does not seem to be in the cards. "It would take an unforeseen, unlikely disruption of crude oil or ethylene to raise prices to that level, and I don't see that scenario in 1992. I don't think pricing will have negative impact on demand" of petrochemical-based feedstocks in 1992, Johnson points out.

α-Olefin "volumes have gone up considerably" over the past 12 months, adds Johnson, "particularly noticeably in the first half of the year." He adds that the soap and detergent business is "more seasonal than one would expect" in a business that sells its products year-round. Business was slower "through the second half."

Johnson reports that Chevron's α-olefins sales were up 40% in 1991 from 1990, noting "strong customer demand." The increase in sales volume also reflects the additional output from its 250 million lb-per-year normal α-olefins unit, which went on stream at the Cedar Bayou plant in Baytown, Tex., in May 1990. (The unit was idled five months after its startup by a fire, but was restarted in March 1991.) And Johnson is "anticipating a strong first half again. We don't see any falloff, rather we anticipate an increase in demand in 1992."

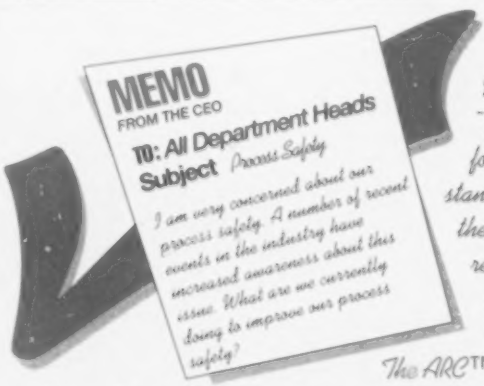
Aiming to better meet its customers' needs, Chevron is proving out a new, lower paraffin technology for its α-olefins production, says C. Eric Spore, a product specialist in Chevron Chemical's olefins and derivatives division. The new technology, which likely will be commercialized this month, will produce a purer α-olefin product for its customers, including those in the soap and detergents business.

For its part, FMC has been working on a new technology to help soap makers cut raw material costs in the midst of the recession. Last February, the company was awarded a patent for a new detergent manufacturing technology using soda ash and surfactants. Ba-

## Eight U.S. companies produce surfactants, raw materials

| | Surfactant raw materials | | | |
|---|---|---|---|---|
| | Linear alkylbenzene | Detergent alcohols | Ethylene oxide | Surfactants |
| Hoechst Celanese | | | ■ | Alcohol ethoxylates |
| Monsanto | ■ | | | Alkylphenol ethoxylates |
| Procter & Gamble | | ■ | | Linear alkylbenzene sulfonates, alcohol sulfates, alcohol ether sulfates, alcohol glyceryl ether sulfonates, fatty amine oxides, fatty alkanolamides |
| Shell Chemical | | ■ | ■ | Alcohol ethoxylates |
| Sherex Chemical | | ■ | | Fatty alkanolamides, fatty amine oxides, alcohol ethoxylates |
| Texaco Chemical | | ■[a] | ■ | Alcohol ethoxylates, alkylphenol ethoxylates |
| Union Carbide | | | ■ | Alkylphenol ethoxylates |
| Vista Chemical | ■ | ■ | | Linear alkylbenzene sulfonates, alcohol ethoxylates, alcohol ether sulfates |

**Note:** 1990 data; some surfactants may be used captively only and some companies offer additional surfactants produced through toll arrangements. **a** Although Texaco has no detergent alcohol capacity, it obtains its alcohols from Ethyl Corp. through a long-term arrangement. **Source:** SRI International's 1992 Chemical Economics Handbook



MEMO
FROM THE CEO
TO: All Department Heads
Subject Process Safety
I am very concerned about our process safety. A number of recent events in the industry have increased awareness about this issue. What are we currently doing to improve our process safety?

**SOLUTION:**

*We must move away from simply screening for hazards to understanding and characterizing them. Therefore we recommend purchasing an Accelerating Rate Calorimeter (ARC™).*

*The ARC™ was specifically designed to study runaway reactions. It is easy to use with fully automated operation. This reliable and widely accepted instrument can be used not just to study problems associated with reactors. But also to obtain vital temperature and pressure data for other processing, storage, transportation and compatibility situations. With it's sensitivity of 0.05 w/kg, we will obtain crucial data about the initial transition from stability to instability. This data will enable us to design strategies to improve our safety. Such data is simply not available from insensitive, low-cost screening techniques.*

**Smart Solutions To Today's Problems**

**COLUMBIA SCIENTIFIC INDUSTRIES CORPORATION**

P.O. Box 203190 • Austin, TX 78720 • (512) 258-5191 • 1-800-531-5003 • Fax: (512) 258-5004

CIRCLE 11 ON READER SERVICE CARD

sically, the process will allow manufacturers to neutralize surfactant acids with soda ash, resulting in cost savings when compared with the purchase of surfactants already neutralized. The new process technology helps manufacturers develop dry, free-flowing granular detergents, according to FMC's Carfagno. "As the trend toward compacted detergents grows, the industry is increasingly interested in higher density detergents that are more weight-to-volume efficient; this often means non-spray-dried detergent manufacturing technology," he explains.

The company has already licensed the process to one "major soap and detergent" manufacturer that it declines to name and is now offering it to other companies, according to Michael J. Ruffini, soda ash product manager for detergents at FMC. "Soda ash is becoming a more important raw material in home laundry detergent formulations because the chemical is one of the lowest cost, effective ingredients," adds Ruffini.

Carbide is clearly upbeat about its future in the surfactants business. Elling expects that the total market for surfactants will not change much in 1992, but that there will be plenty of replacements among types of surfactants. Carbide, he anticipates, will be on the displacing side of that trend. "We will have some new product offerings in 1992 that will increase our market share," says Elling. Although he says Carbide is not ready to unveil those products, he adds that they are ones that "we believe are better [than others currently available] at competitive cost."

Besides its November 1990 purchase of Rohm & Haas' Triton surfactants and alkylphenol business, last September the company also unveiled plans to build a specialty surfactant plant at its South Charleston, W.Va., chemicals complex. The 50 million lb-per-year plant, slated for completion by mid-1993, will be capable of producing the full range of Triton brand specialty surfactants. Currently, Rohm & Haas is producing the surfactants for Carbide at its Philadelphia plant.

Marking another major investment in surfactant capacity, American Cyanamid plans to expand and modernize its Warners, N.J., sulfosuccinate surfactant operation by the fourth quarter of this year. The move will increase Cyanamid's Aerosol brand surfactant capacity by about 10 million lb. Cyanamid's Aerosol, Aerodri, Deceresol, Complemix, and Solusol sulfosuccinate, sulfosuccinamate, and docusate surfactants are used in a broad range of applications, such as general-purpose cleaners, cosmetics, emulsion polymerization, textile finishing, mineral ore processing, food additives, pharmaceuticals, plastics, paints, inks, coatings, and agricultural products. The economy of scale and equipment versatility afforded by the expansion will enhance Cyanamid's surfactant production as well as improve its custom manufacturing and tolling capabilities, says the company. The new capacity will also help Cyanamid expand its surfactant presence through product line extensions, new product introductions, and strategic alliances.

Sherex, which manufactures a range of over 100 products from natural fats and oils, is also enthusiastic about 1992. There's been a lot of movement in the household cleaning area over the past year with companies including Clorox and Procter & Gamble introducing new products, says Pamela D. Shisler, industry manager for household and industrial surfactants at Sherex Chemical. Their competitors "will need their own entries," so she expects that in 1992, the household cleaners market will remain dynamic with new products creating "new opportunities for specialty surfactants."

Those are among the opportunities that the company is hoping to turn into market share. "We have a smaller percentage of the market, so we have a lot more potential to grow. We expect to perform better in 1992 as the trend toward specialties begins to snowball."

Just how well Sherex and other specialty surfactant makers fare in 1992 will have something to do with how feedstock prices behave. Coconut oil prices, which rose during the summer, are still high, keeping the industry

Looking for a safer, more powerful solvent?

**Look here first.**

DMSO (dimethyl sulfoxide) is a powerful, polar, aprotic solvent. It can increase yields and can be recycled easily.

DMSO is also one of the safest industrial solvents you can use. Its toxicity parameters are similar to those for glycerine or ethanol.

But, will DMSO solve your solvent problems? Gaylord can help you find the answer. We have the world's largest data base on DMSO.

Call 800-426-6620. We'll send technical data to get you started.

GAYLORD CHEMICAL CORPORATION

P.O. Box 1209
Slidell, LA 70459-1209

CIRCLE 25 ON READER SERVICE CARD

wondering when they will drop again. Shisler adds: "They've got to come down sometime."

Specialty feedstocks are generally more expensive than the commodity feedstocks they can replace, she explains, but the overall cost can end up the same because a customer may use less of the specialty replacement, which is often more environmentally friendly. "So a customer gets a bigger bang for the buck."

While the industry reformulates with different surfactants, it also continues to struggle to come up with acceptable substitutes for phosphates in their use as builders. Phosphates are indisputably the most efficacious builders for use in heavy-duty laundry detergents and automatic dishwasher detergents, but more than a decade of negative publicity and burgeoning state legislation have brought about a decline in their use in detergents.

Recent technology has provided improved phosphate-free laundry products. For example, liquid laundry detergents, which contain no phosphate, now have half of the market in some areas, according to SDA. This has been achieved using a number of alternative builders including zeolites, sodium citrate, sodium carbonate, and sodium nitrilotriacetate.

The banning of phosphates in laundry detergents continues to contribute to a number of reformulation changes in the industry. For one, phosphate regulations have contributed to growth in laundry liquids, most of which do not contain builders. It has also boosted demand for surfactants because more of them are needed to achieve acceptable performance from unbuilt products, according to a report on surfactants, household detergents, and their raw materials released this month by SRI International.

An even bigger challenge is dealing with the phosphates' crucial role in automatic dishwasher detergents. The industry has found no way to replace phosphates in critical cleaning operations such as automatic machine dishwashing in homes, restaurants, and institutions and the cleaning-in-place of food and beverage equipment such as in dairies, says SDA. A veritable substitute must not only be effective at reasonable cost, it must also be safe for home use, safe to crawling infants who can get detergent out of dishwashing

PFANSTIEHL

Look to us for building blocks for anti-viral work

The capability starts with our basic product line of blocked sugars, nucleosides, and a broad range of carbohydrates for the life sciences and key intermediates for anti-viral R&D. We are also leaders in the production of ultra high purity, low endotoxin sugars for use in parenteral nutrition and other critical applications, such as tissue culture work. In the life sciences, we've got the blocks to build on.

PFANSTIEHL LABORATORIES, INC.
*The source for carbohydrate chemistry*
1219 Glen Rock Avenue Waukegan, IL 60085-0439
Tel:1-708-623-0370 Toll Free:1-800-383-0126
FAX:708-623-9173 Telex 25-3672 Pfanlab
57-P

MAKING THINGS WORK

CIRCLE 29 ON READER SERVICE CARD

Can DMSO solve your solvent problems?

Check our data base.

Gaylord Chemical can give you access to more than 15,000 abstracts, articles and patents, containing the best technical information that has been published about DMSO.

DMSO is a safer, more powerful solvent. With Gaylord's unique data base, you can find out quickly if DMSO will solve your solvent problem.

Call 800-426-6620. We'll send technical data to get you started.

GAYLORD CHEMICAL CORPORATION
P.O. Box 1209
Slidell, LA 70459-1209

CIRCLE 26 ON READER SERVICE CARD

dispensers, and safe for the environment. Current research is focusing on organic builders, polymers, enzymes, and oxygen bleaching systems, according to SDA.

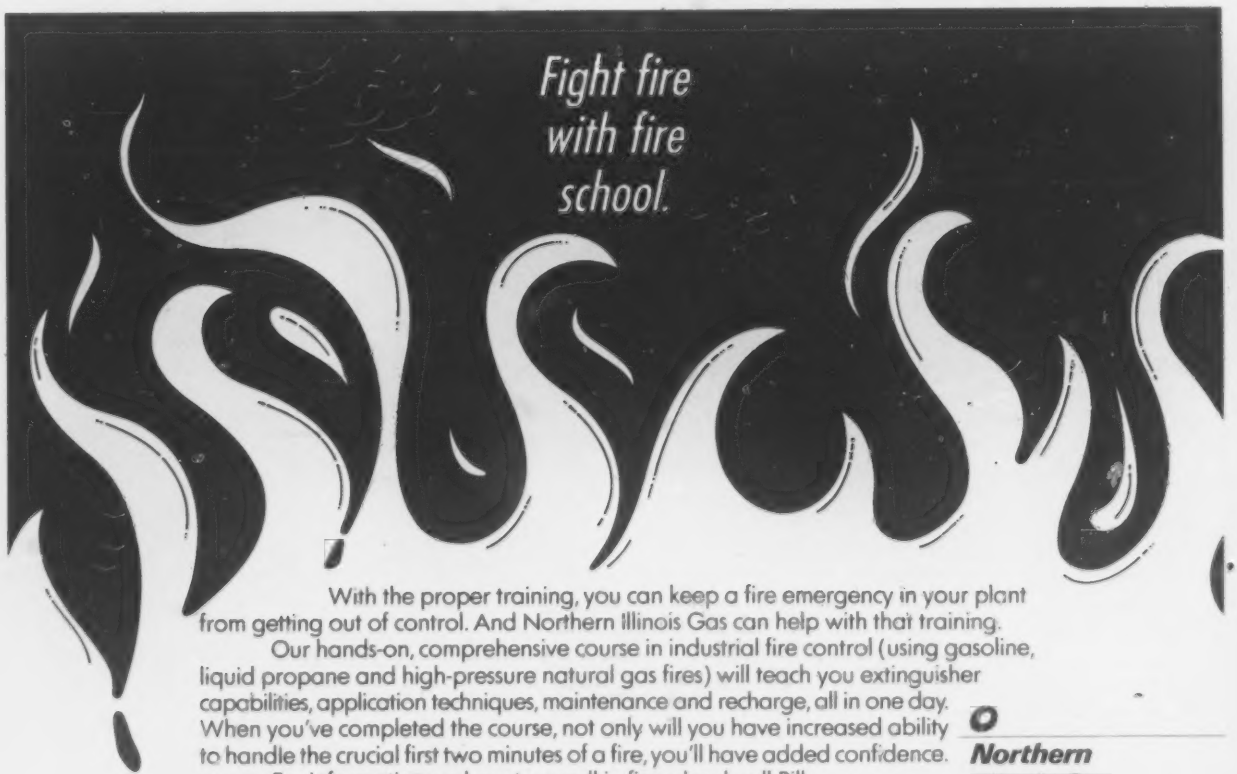
As soap and detergent formulators look for builders that have a better environmental quality profile, they are also investigating the use of more environmentally friendly peroxygen chemicals across the board in home laundry detergents, liquid all-purpose bleaches, automatic dishwashing detergents, consumer multipurpose cleaners, and industrial and institutional products.

With the successful U.S. introduction of concentrated home laundry detergents almost behind them, national and regional detergent manufacturers are now focused on work to add peroxygen bleach to more of their home laundry products. A number of detergent products such as Tide with Bleach are already on the shelves, and the market is clearly headed in that direction. When concentrates have fully penetrated the market, soap and detergent manufacturers will more heavily promote this new product benefit, sources say.

Activity is also accelerating to further develop and market hydrogen peroxide as a separate liquid bleach product that is added directly to the washload. The trend to use of peroxide-based bleaches continues to grow because peroxide, "an environmentally safe chemical, provides excellent cleaning performance without color or fabric damage," according to FMC's Caropreso.

Vista Chemical photo

*Formulators test detergents for dishwashing and home laundry*


With the proper training, you can keep a fire emergency in your plant from getting out of control. And Northern Illinois Gas can help with that training.

Our hands-on, comprehensive course in industrial fire control (using gasoline, liquid propane and high-pressure natural gas fires) will teach you extinguisher capabilities, application techniques, maintenance and recharge, all in one day. When you've completed the course, not only will you have increased ability to handle the crucial first two minutes of a fire, you'll have added confidence.

For information on how to enroll in fire school, call Bill Skinner at 708-983-8676, ext. 2777. It could be one of the most important calls you'll ever make.

Northern Illinois Gas

PROVIDING YOU THE ENERGY TO PERFORM.

CIRCLE 32 ON READER SERVICE CARD

## Cost-effective, environmentally friendly products challenge raw materials supplies

The market for industrial and institutional cleaners, the largest market for surfactants, had a weak year in 1991. What's more, it will probably remain "slow as long as the recession" continues to plague restaurants and hotels, for example, notes Pamela D. Shisler, industry manager for household and industrial surfactants at Sherex Chemical. Fewer patrons mean a decreased need for cleaners and disinfectants.

Despite suffering demand, the recession has put increasing pressure on soap and detergent manufacturers to provide cost-effective products. And environmentally conscious manufacturers and consumers also want products that have minimal environmental, safety, and health effects. These challenges could spell opportunities for raw materials producers that can come up with products to meet these growing demands.

"I think there are definite environmental issues that to a degree are affecting industrial detergents and processes," says George Elling, market development manager for Union Carbide's surfactants business. For example, he adds, "people in industry have to be more and more concerned about effluent from plants, considering that the waste treatment authorities at the state, local, and federal levels will not allow them to have anything but almost pure water in their waste streams. This means that people have to look at the chemicals and processes they are using so as to keep virtually any organic, heavy metal, or environmentally unfriendly product from leaving the plant." If a company is using a surfactant that is very difficult to treat in a water treatment plant, and the local water authority can't process it, the company will have to reformulate. Developing and marketing surfactants for this reformulation process opens up potential markets for surfactant producers, he adds.

In the past few years, there has also been an increasing emphasis on sanitation, probably because of greater public awareness of health concerns, says Marilyn Bradshaw, a business manager at Colin A. Houston & Associates, which recently published a study, "Industrial Applications of Surfactants-North American Forecast to 2000." This could spell growth for disinfectants and sanitizers.

Another issue affecting industrial and institutional markets is the decreased language skills of the work force, she notes. "Many employees who use the cleaning products are either barely literate or do not speak or read English. In order to ensure safety and economy, products must be very easy to use, and premeasured or automatic dosing is preferred," says Bradshaw.

FMC's Peter P. Carfagno, detergent products technology manager, agrees. "In the industrial and institutional area, there is continued interest among formulators to develop novel product forms that will provide automated, metered delivery of detergents for [automatic dishwashers] and other cleaning compounds. These provide benefits in performance, cost savings through more efficient use, and enhanced worker safety through minimum exposure."

The demand for safer industrial and institutional formulations may also open up a new market niche for surfactant suppliers. Traditionally, the industrial sector has relied more heavily upon synthetics, such as aromatics and other petrochemicals, than the household and personal care sectors. The household and personal care sectors are more heavily dependent upon natural fats and oils, because mildness and low irritation qualities are required for skin contact applications. But that is changing. Alkaline cleaners, although remaining the leading segment of industrial and institutional cleaners, "will face increasing supplantation by specialty cleaners and safer synthetic cleaners," notes a recent surfactant study by the Freedonia Group, Cleveland.

Energy conservation and improved cost and performance continue to be important in this market, Bradshaw says. Wash temperatures are lower and use of liquid products is growing at the rate of 8% per year at the expense of dry products. That's because liquids can be easily and accurately injected in measured doses into closed systems. In addition, they require no heat for dissolving and all components are immediately available in solution, which is important in low-temperature cleaning. Liquids also eliminate the handling problems caused by dust in dry detergents.

Powders are also declining in the commercial dishwashing products category—in part because of preference for liquids and slurries, but mostly because of the increasing popularity of Ecolab's encapsulated solid-product system, which automatically dispenses concentrated dishwashing detergent, notes Bradshaw.

However, there are some exceptions to the trend toward liquids. In the hard surface cleaners category, for example, the trend from powders to liquids has leveled off and may even be reversing slightly because of environmental concerns about plastic packaging of liquids, Bradshaw says.

Packaging has been an important area of change in recent years, she says. Many large-volume products are being packaged in a "bag-in-a-box" form rather than the 5-gal pails and the 55-gal drums that were common in the past. The 55-gal drums are difficult to move and make disposal a problem. The new packaging forms are less bulky, less costly, and more environmentally sound. For these same reasons, bulk delivery of large-volume products is becoming more and more common.

"The focus on peroxygens for use in consumer cleaning compounds is widespread, and we expect to see peroxygens formulated into multifunctional cleaners and automatic dishwashing products as well as [their] continued use in liquid bleaches and home laundry products," adds Caropreso.

Du Pont's Fanandakis notes that peroxygens are displacing chlorine in most of these uses. "In [automatic dishwashing detergents], for instance, chlorine is already pretty much displaced in the European market," he says. "And that will probably happen in the U.S., too, in the next year or so."

In the industrial and institutional area, researchers are looking at developing a formulation of hydrogen peroxide and peracetic acid to be used as a sanitizer for cleaning applications in food and beverage processing plants, notes Caropreso. John Parker, marketing manager for persalts at Interox America, says he sees "major interest in this market area," in which Interox

is a "very significant" player in both Europe and the U.S.

Recognizing the potential for growth in demand for peroxygens, both Du Pont and Interox America moved forward in 1991 with capacity investments. In December, Interox America started up a new plant in Deer Park, Tex., to produce sodium perborate monohydrate, a solid peroxygen bleaching chemical used in heavy-duty detergent powders and bleach additive products. The facility has an initial capacity of 45 million lb per year of monohydrate in detergent powders and was designed for future expansion to enable Interox America to keep pace with a rapidly growing market.

Du Pont became the first North American producer of sodium perborate monohydrate last year with its unit at Memphis, Tenn. Rather than build a new plant, the company dedicated a portion of its perborate tetrahydrate capacity to supply over 30 million lb per year of monohydrate. Du Pont says this is the first phase of adding monohydrate capacity to meet a growing demand in North America and the rest of the world. As demand increases, Du Pont claims it will also be "in an excellent position to expand our capacity," says Fanandakis.

According to Parker, worldwide demand for this product has doubled between 1987 and 1989 "and further substantial growth is predicted." In five years the potential North American market for monohydrate is estimated at 60 million to 80 million lb per year, says Fanandakis.

In Europe, the monohydrate variety is replacing perborate tetrahydrate in concentrated powders. Meanwhile, in North America and Japan, the introduction of new technology has opened up new demand for monohydrate. Basically, sodium perborate monohydrate is preferred over tetrahydrate because it dissolves faster and gives better stability for low- or no-phosphate detergent formulas.

To meet the changing needs of the soap and detergent industry, companies are also developing a host of other additives and products that provide more than one function and do so at reduced cost. For example, besides marketing its soda ash for use in neutralizing surfactants, FMC is also pushing it as a builder, an agglomerating agent, a surfactant carrier, and as an alkaline source in detergents. "Soapers need maximum performance, and that is why soda ash is becoming a more important raw material. Of all the active ingredients in home laundry detergents, soda ash is one of the lowest cost, most effective raw materials," says Ruffini.

Meanwhile, Dow Chemical is boosting worldwide capacity for its Dowanol glycol ethers, which act as surfactants and coupling agents in household and industrial hard surface cleaners, floor waxes, carpet cleaners, metal cleaners, disinfectants, and germicides. Cleaners make up the second largest end-use market for glycol ethers after paints and coatings. Dow is currently in the process of expanding its

STN Express®: the fast track to searching scientific databases

STN® INTERNATIONAL

**Easy connection to STN®**

Step aboard STN Express® (for the IBM® AT and PS/2 and Apple® Macintosh), the software that will quickly log you on to STN International® and help you prepare your questions *offline*, before online charges are incurred. Then you can upload and execute your search and produce *print-quality output of both text and graphics*.

**Easy structure searching**

You can draw structures freehand or with templates or venture into molecular modeling. Once you've defined the structure the way you pictured it, *search for it among the 10 million structure diagrams in the CAS Registry file*. Was there a match? If so, that's a valuable piece of information. No match? Knowing that could be *invaluable*.

**Let STN Express introduce you to online searching and STN International. They'll take you searching where you've never been before.**

**YES! Please send me the FREE STN Express evaluation package.**

Name _____

Position _____

Address _____

_____

Phone _____

STN International, c/o CAS, Marketing, Dept 35292, P.O. Box 3012, Columbus, Ohio, 43210-0012
FOR FASTER SERVICE call 614-447-3731, 800-933-4350, or FAX this completed coupon to 614-447-3713.

Stade, Germany, glycol ether facility. The expansion, which will be completed in 1992, will increase Dow's total glycol ether capacity to 485 million lb per year. The company has two U.S. manufacturing locations—Midland, Mich., and Plaquemine, La. Dow also manufactures glycol ethers in Terneuzen, the Netherlands, and San Lorenzo, Argentina.

It is increasingly important for U.S.-based raw materials suppliers and soap makers to remain active both domestically and globally. Markets in the U.S., Western Europe, Japan, and East Asia are all estimated to be about the same size, according to the Department of Commerce report. Sociodemographic trends will play a major role in future international development. Population has stopped growing in Europe and Japan, where the average age of consumers is increasing and households are getting smaller. Climate and types of washing machines will also be factors in determining the industry's global marketing efforts, says the report.

Both industrialized and developing countries have the potential to provide significant market growth, the report adds. There is a close correlation between a country's consumption of soaps and detergents and its standard of living. The industry's frequent introductions of new products reflect improved technology and ever-changing consumer preferences.

Events in Eastern Europe and the republics of the former Soviet Union will present challenges and opportunities, starting with additional exports and leading later to enhanced investment opportunities as these countries move to market economies.

"Economies in transition may present the biggest opportunity in this decade," the Commerce report says. "With investment dollars limited, U.S. companies face difficult choices. But they will need to move quickly because international competition will be keen. Although overcoming trade and investment obstacles will take time, Eastern Europe appears to offer attractive opportunities for exports—at least until the private sector builds production capacity. Domestic demand, geography, cost of fuel and feedstock, and a ready labor force may make the Eastern European countries an ideal location for world-scale plants with sufficient capacity to eventually export to Western Europe and Asia."

When it comes to opportunities in Eastern Europe, Chevron Chemical is one raw material supplier that has its foot in the door. In 1987, the company licensed its technology to the Czechoslovakian government. Under the deal, Chevron will be able to obtain surplus product from the country's new 265 million lb α-olefins plant when it becomes operational in June or July of this year. Chevron has been helping with the start-up of the plant. For example, last fall it helped to train 26 Czech plant operators at its U.S. α-olefin facilities.

The Czechs will supply Eastern Europe with the new plant and Chevron will be free to sell whatever the Czechs cannot to Western Europe. Detergent alcohols are likely to be low on the list of what Chevron can tap from the Czech plant. "The detergent alcohol fractions are spoken for. Obviously, they have established a home for these products in those countries," says Johnson. Given that "we and other suppliers have not been supplying detergent alcohols over there," they probably were not used before in those countries. Thus he wonders if Eastern Europe is now in the process of converting away from branched alkyl benzene, which has been the old standby there for many years.

Given the importance of international markets to soap and detergent raw materials suppliers, it's not surprising that many of them are working toward the goal of International Standards Organization (ISO) certification. Du Pont expects that its Memphis solid peroxygens facility, which includes the perborate as well as potassium monopersulfate units, will be ISO 9000 certified by the first half of 1992. "The [change in the] European Community this year is part of what is driving us toward that goal," says Fanandakis. "We are a global supplier; we service all markets and we do export some of our [detergent-related] products."

Chevron Chemical, which does a big export business in α-olefins, detergent alcohols, and other soap and detergent feedstocks, is working on its ISO 9000 certification, aiming to meet that goal by August of this year. "Our customers in the detergent business want this," says Johnson, "but everyone in the chemical industry is marching in harmony toward these goals." □


ACS INSURANCE PLANS

**Deferred Annuity and Individual Retirement Annuity (IRA)**

Funded by Lincoln National Life Insurance Company A+ A.M. Best & Company

Endorsed by the Board of Trustees, Group Insurance Plans for ACS Members

All 1992 contributions will receive no less than 7% guaranteed interest rate through December 31,1993.

Contributions may be made at any time.

**First Quarter Interest Rate Compounded Daily is**

**7.30%***

*Effective annual yield

For more details, please call, write, or mail this coupon to:

**Independent Plan Coordinators, Inc**
**4601-H Pinecrest Office Park Drive**
**Alexandria, Virginia 22312**
**Toll Free #1-800-368-3515**

Name_____

Address_____

_____

_____

City_____

State_____ Zip_____

92067

CIRCLE 46 ON READER SERVICE CARD